ARAT BULLETIN

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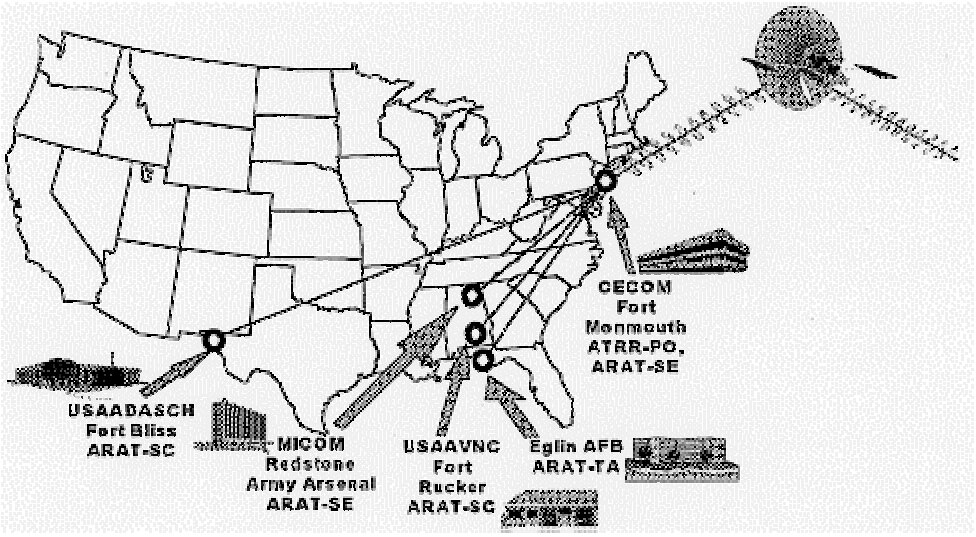
Connecting The Army Reprogramming Community: The ARAT Wide Area Network (WAN)

(See Page 1)



What's Inside:

ARAT Site Connectivity: SIPRNET Becomes A Reality!

Part III In A Series

This is the third article in a series on the ARAT Wide Area Network (WAN). Part I (1/95) described ATRR-PO s rationale for establishing a WAN. Part II (4/95) delved further into the various WAN connectivity options being researched and tested. Part III will highlight accomplishments to date, focusing on the recent installation of a Secure Internet Protocol Routed Network (SIPRNET - formerly DSNET1) workstation at Ft. Monmouth, NJ.

The nucleus of the ARAT WAN resides in the Software Engineering Directorate (SED) at Fort Monmouth. It is a Sun Sparc 2 workstation which hosts the ARAT World Wide Web (WWW) Home Page. This WWW Home Page, currently under development and testing, will contain numerous links to services (e.g., E-mail), and data files/databases stored both locally (on atrrpo) and remotely at various places throughout the national intelligence community. As such, the Home Page will constitute a central "one stop shopping" focal point for any user trying to access critical reprogramming data, regardless of the location of the user or the data. As mentioned in Part II, atrrpo and its secure home page can be accessed by three means: via the Defense Switched Network (DSN - formerly AUTOVON) or commercial phone lines using a STU-III, via MILNET using a properly configured Network Encryption System (NES), or through SIPRNET.

STU-III phone line connectivity into the ARAT WAN is the most cost effective method for ARAT community users to access atrrpo and its home page. A user requires a STU-III with a SECRET collateral key, either a Unix workstation or a PC running Transmission Control Protocol/Internet Protocol (TCP/IP) software, and a web browser like Mosaic or Netscape. Currently, there is only one line available to call into atrrpo, but three more will be available soon. The STU-III is keyed and set for Auto-Answer, Auto-Secure to allow 24-hour secure access. The Project Office is currently working on the TCP/IP software configuration for a PC and acquiring additional software licenses. Once completed, a disk containing a compressed file will be made available to the ARAT community. It will include explicit instructions to load and configure the web browser application and accompanying protocols. The Project Office will also provide assistance if needed.

A more expensive alternative is secure Internet access using a NES. Access to the ARAT Home Page is available to any ARAT community user with a Unix workstation or PC running TCP/ IP software, a NES with the proper cryptographic configuration files, and Internet access through the Nonsecure Internet

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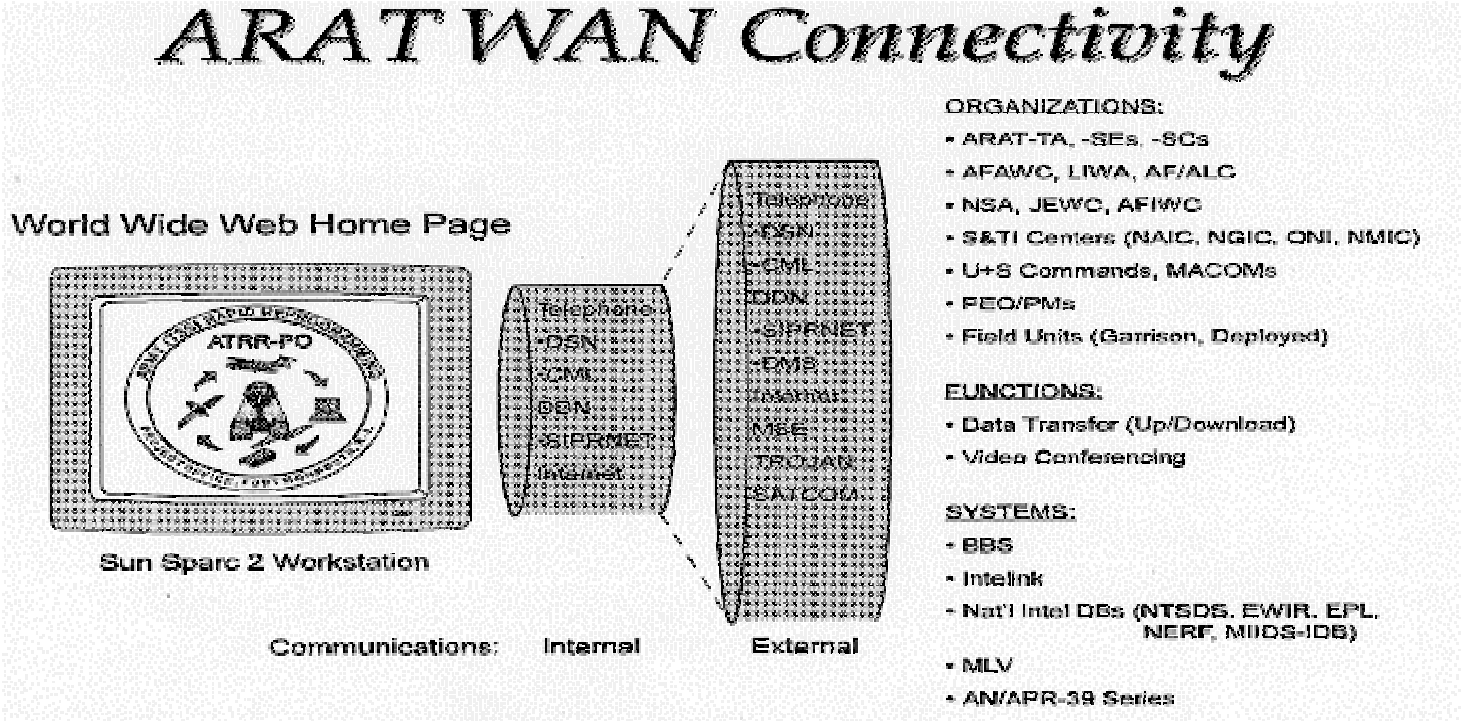
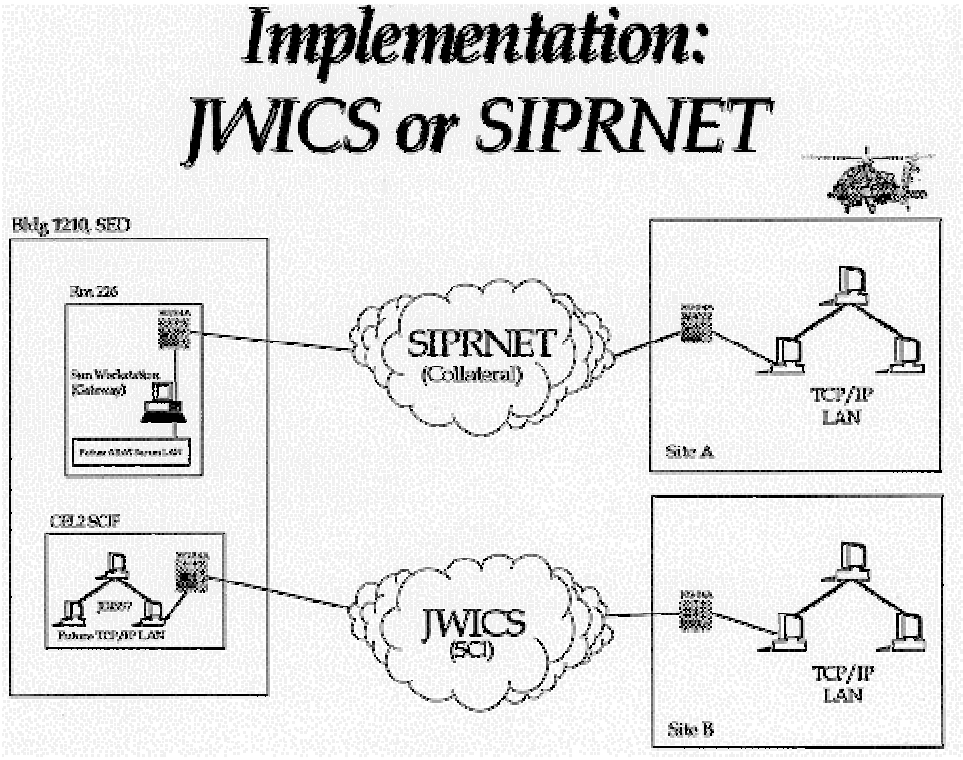


ARAT Site Connectivity (Continued)

Protocol Routed Network (NIPRNET - formerly MILNET) or any Internet service provider. The ATRR-PO NES is currently available on a 24-hour basis for connection to the ARAT-Threat Analysis (ARAT-TA) team, the Air Force Air Warfare Center (AFAWC) analysts at Eglin AFB, FL, and the Air Force/Air Logistics Center (AF/ALC) analysts located at Warner-Robins AFB, Georgia. The cryptographic software files in use by the NES are currently configured and controlled by the system administrators at the AFAWC (POCs are SSgt Bennie Bittle/Msgt Jerry Rogers, DSN 872-8905/6, CML (904) 882-8905/6). The cryptographic files are created through a proprietary program that runs on an IBM-compatible PC known as a NES Product Server (NPS). The ATRR-PO has ordered the NPS software and will configure and control the cryptographic files for ARAT community NESs when the software and the additional NESs arrive.

The last method of access into the ARAT WWW Home Page is through SIPRNET. SIPRNET access requires a user to have a Unix workstation, a National Security Agency (NSA) encryption device (KG-84/ 194) with appropriate keying material, and a point-to-point data quality circuit to the closest SIPRNET hub. The Defense Information Systems Agency (DISA) is the controlling authority for SIPRNET. If a user is stationed at a base with an existing SIPRNET hub, then they simply require a local data line, which only incurs a flat hookup fee. If there is no local SIPRNET hub, however, then a user must pay a monthly charge for a long distance leased line to the nearest DISA appointed hub, in addition to the hookup fee cost.



SIPRNET is similar to DSNET1 in that it allows a user connectivity to other hosts within the SIPRNET network, assuming they have an account (UserID and Password) attained through prior coordination with the particular agency. Where SIPRNET differs, however, is that it now has a WWW browser capability similar to the Internet called InteLink, that uses Mosaic or Netscape to access secure web sites. Upon completion, the ARAT WWW Home Page will be registered in InteLink for access by users with SIPRNET connectivity. It is also envisioned that users accessing the home page via STU-III or NES will be able to request atrrpo to act as their proxy agent in data retrieval via SIPRNET. This desirable capability is still under research, particularly with regards to security implications and authorization.

In a deployed environment, it is anticipated that phone line and/or SIPRNET access will be available in theater, down to and including the Corps level. Although not guaranteed nor planned for, Internet access may be available if deployment is to a country or area that already has Internet capability. Deployed access can be illustrated as follows: a unit can tie into the ARAT Home Page via whatever means available and read its E-mail, which notifies them of a Mission Data Set (MDS) update. The unit retrieves and down- loads the file(s) onto their computer (running TCP/IP) through file transfer protocol (ftp), regardless of the location of the file(s). The MDS can be saved onto a floppy disk and then read into a Memory Loader/Verifier (MLV). The MLV is subsequently used to load the updated MDS into the designated rapid reprogrammable platform (i.e. a radar warning receiver, AN/APR-39A (V) 1, on a helicopter).

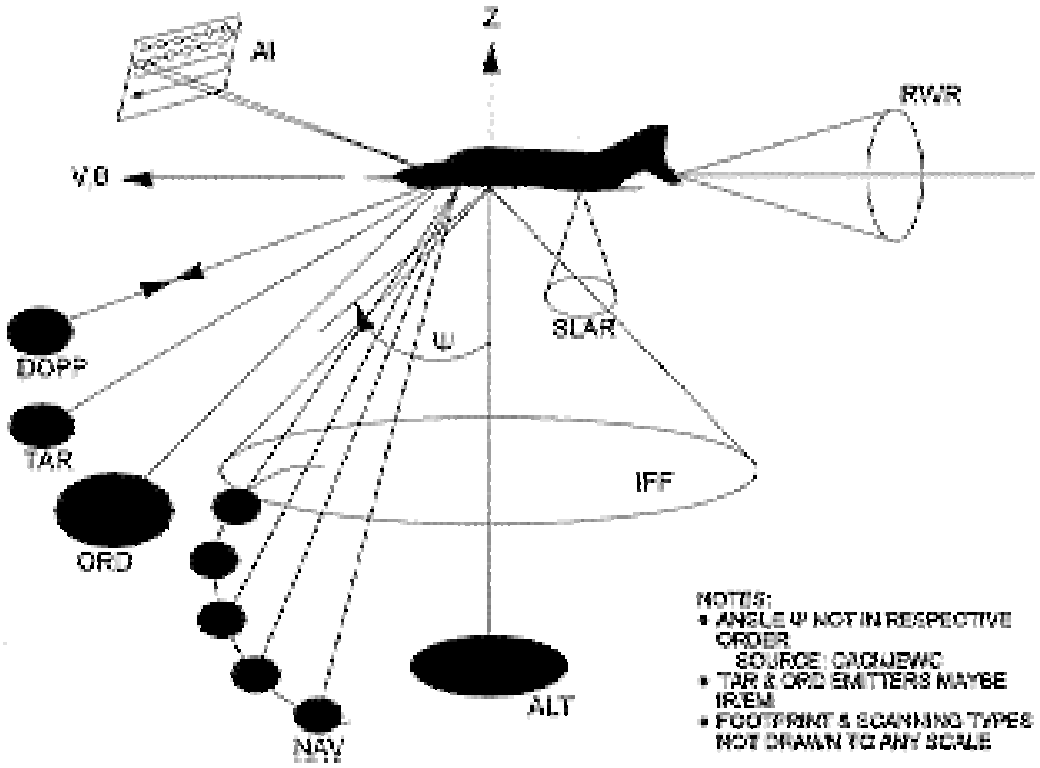
Future articles will keep the ARAT community and other users informed about WAN developments. The next one will provide a more in-depth explanation of the ARAT WWW Home Page capabilities, to include connectivity to the BBS at Eglin Air Force Base (AFB), Florida. POCs are Mr. Ken Kragh/Mr. Andrew Lombardo, DSN 992-6003, CML (908) 532-6003.

An Air Defense Artillery Reprogramming Tool: The Electronic Fit Information System

"The man who is prepared has his battle half fought."
Cervantes: Don Quixote, ii, 17.1605

The Electronic Fit Information System (ELFIS) software program was developed by the Directorate of Combat Developments, United States Army Air Defense Artillery School (USAADASCH), Fort Bliss, Texas to assist in the development and maintenance of Electronic Support (ES) tactical libraries for weapon systems. This program provides a means to achieve precise updates to tactical libraries to abrogate planned abrupt changes which occur to friendly and threat emitter signatures. ELFIS provides the capabilities to perform electronic fits, data queries, ambiguity analysis, flagging analysis, and histogram displays. These help optimize ELNOT selection into a tactical library.

ELFIS represents a computerized, methodology that emulates what is classically known in Electronic Intelligence (ELINT) analysis as an Electronic Fit and its concommitant analytical modules. ELFIS methodology was designed in an object-oriented fashion. The reason was to accommodate many non-similar data bases which do not conform to standard formats. Since the originators of the data bases used by ELFIS are diffuse and their goals are different, ELFIS had to conform to variable format input techniques. Classically, an Electronic Fit done manually on a relatively simple scenario involving few players would take months to complete. A good measure of performance (MOP) of ELFIS is that such scenarios can be accomplished in the order of minutes.



(U) Figure 1: Notional representation of the types of airborne emitters, and their associated footprints, that ELFIS contains in its databases.

The ELFIS system is comprised of two major parts: the program and the data bases. The program is written in Clippertm, a C language derivative database query language. The data bases include the ELINT databases which comprise the three major categories of the Electronic Fit process, and three databases that are utilized for Ambiguity Analysis, Flagging and Histograms. The ELINT data bases used for Electronic Fits are Country versus Platform (C_P), Platform versus Electronic Notation (ELNOT) (P_E), and ELNOT versus Frequency (E_F) lists. Those data bases used for Ambiguity, Flagging and Histograms are the Master Data Base (MDB), the MDB+, and the MDB-. The MDB is where viable, in-band emitter parametric data is stored. The MDB+ is where potentially viable and in-band emitter parametric data is stored. The MDB- (also called the Deletion List), is where emitter data that is not viable is kept. The viability of emitters is established by the system manufacturer and thus, the contents of the MDB trilogy is system dependent and included as part of the ELFIS system and updated for the user. It should be noted that due to the object-oriented nature of the ELFIS program, ground and naval platform suites can be easily adapted into the Electronic Fit process.

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ELFIS - (Continued)

The major databases used by ELFIS for Electronic Fits, and their sources are:

- For the Country versus Platform (C_P) suites, the Air Order of Battle (AOB) produced by Defense Intelligence Agency (DIA)
- For the Platform versus ELNOT (P_E) suites, diverse sources as illustrated below
- For the ELNOT versus Frequency (E_F) suites, diverse sources as illustrated below

The accuracy of the system's results is directly proportional to the accuracy of its input. Therefore, the user must be knowledgeable in the areas of Electronic Fit and Ambiguity Analysis. At the Fort Bliss ARAT-SC, the ELFIS database is continually updated, which allows for its utilization throughout all stages of the analysis process.

With the increasing world inventory of smart munitions and computer-aided weapon systems, which by definition are driven by Tactical Scenario Libraries that steer computer embedded code and/or signal collation and identification, it has become paramount to examine the effects of Electronic Warfare (EW) degradation. The EW effects have to be addressed in a near real-time manner due to the volatility of modern battlefield scenarios. A good measure of how EW effects are addressed is in the speed and accuracy of reprogramming tactical scenario libraries, an arena where the ELFIS produces definitive results.

The ELFIS operates in a Personal Computer/MS-DOS environment, thereby making it portable, and widely distributable. The system is government owned and distributed through the Fort Bliss ARAT-SC office. Additional information can be obtained by contacting Mr. Al Thompson, DSN: 978-5595/ (Comm) (915) 568-5595 (U), or by FAX at DSN: 978-4313/(Comm) (915) 568-4313.

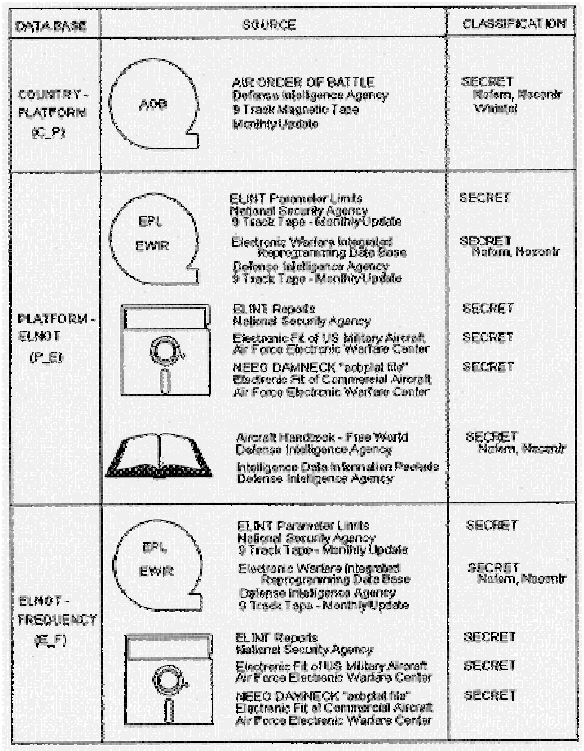


Figure 2: ELFIS Database

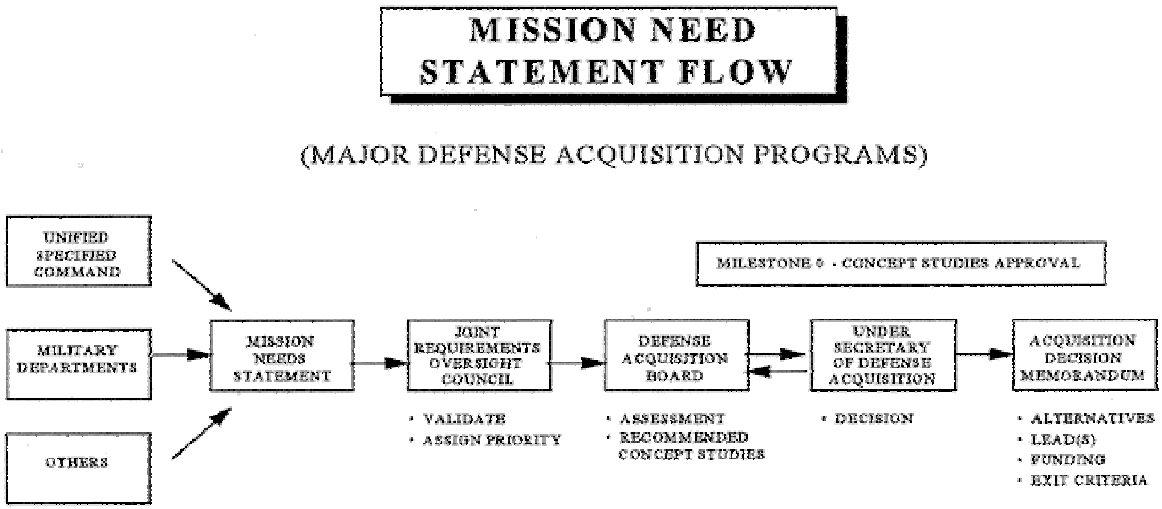
The ARAT Requirements Survey and Acquisition Streamlining

"The Armed Forces will never show a dollar-and-cents profit." Observation by unidentified officer, c.1950, quoted in the Professional Soldier, Janowitz

The Army Reprogramming Analysis Team (ARAT) was founded upon the direction of the Department of the Army through the ***ARAT Implementation Plan*** and Army Regulation 525-15 (***Software Reprogramming Policy for Target Sensing Weapon Systems***). These documents identify the need for standards and policies necessary to improve rapid reprogramming support to the warfighter. The ARAT provides technical support to the materiel development community in response to the need for reprogramming Army smart munitions and radar warning receivers. The success of an approved requirements document will ensure the success of forces on the battlefield and reduce the costs of multiple systems requiring unique reprogramming techniques.

The ATRR-PO is conducting a review of Army systems requiring rapid reprogramming. The effort aims to review and extract specific requirements for reprogramming from existing Mission Need Statements (MNS) and Operational Requirement Documents (ORD). The goal of such an effort is to conform to acquisition directives and allow the Project Office to become even more involved with materiel requirements.

The DOD Directive 5000 series outlines the process to acquire new systems, referred to as Major Critical Defense System (MCDS). The MNS is the kick-off document within that process. The MNS defines in broad operational terms the user's need for a materiel solution. The user (e.g., a Major Command or Commander in Chief) determines that there are no other systems in the inventory that will meet the specific need. Typically, the MNS is introduced by a command, then coordinated within and validated by that Service.



This requirement may be validated for Joint potential (through the Joint Requirements Oversight Council [JROC]), or returned to the originating Service for potential funding within its existing budget. The Service Headquarters (HQs) forwards the validated MNS to the Service Acquisition Authority. The system is programmed for resources by an Acquisition Decision Memorandum (ADM) based upon the validated requirement. The ADM identifies a Project Office or Project Manager to be the lead for the program, and funding is identified to begin studying the requirement. The studies involve every aspect of the new acquisition from concepts of operation to required training needed by the Services to effectively field that system.

An ORD is developed following the concept study phase, and is used in the fielding of the new hardware. The ORD is the user's defined end state. The ORD defines everything from maximum allowable weight to Mean Time Between Mission Failures. The user or, more specifically, the combat developer who is assigned responsibility for the validated system, is responsible for updating the ORD over the life of the program. The ORD

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ARAT Requirements Survey (Continued)

is an evolving document identifying system capabilities to material developers and potential contractors. The ORD is used in the Statement of Work (SOW) or the Request for Proposal (RFP) to identify specific Army requirements for the development of the new system.

Problems in the process occur most often in the ORD. Changes in needs will cause changes in the material development effort and delays which add cost to the overall acquisition. It is important that the Program or Project Manager (PM) prevent the addition of supplementary functions that may adversely affect the acquisition timelime, budget, or "approved" capabilities. The PM is the individual responsible for the overall success of the program.

Acquisition streamlining is the latest DOD attempt to reduce the paperwork volume required to purchase an item for the government. Within high dollar programs, this includes over 30 documents that must be drafted, regularly reviewed, continually updated, and approved at multiple levels throughout DOD. This burden has added to the increased length and cost of most DOD purchases. The effort to reform the acquisition process has been driven at the national level by the White House National Performance Review (NPR).

There has been much discussion on streamlining the current acquisition system, yet the MNS and ORD remain as cornerstone documents. Several programs (e.g., Joint STARS) have requested and received waivers from specific documentation and testing requirements. Even so, the results of acquisition streamlining have been very limited. There have been no substantive reductions of paperwork requirements except for those few programs that have received waivers. In August 1995, changes to the Federal Acquisition Streamlining Act (FASA) were released. The highlights of this update included:

- ***Commercial Contracting***: For the most part, the government will purchase commercially available items vice requiring vendors to meet government unique terms.
- ***Debriefings***: The government must fully reveal its rationale for contract awards based upon request from competitors or awardees.
- ***Contractor Employee Whistle-blowers***: The Federal Acquisition Regulation (FAR) will provide greater protection to Whistle-blowers under Justice Department oversight.

The ARAT survey of reprogramming requirements will most likely lead to the development of a MNS and possible an ORD. The reprogramming community will have an excellent opportunity to better interact with Program Managers based upon validation of a MNS. An approved MNS would allow the ARAT Project Office to communicate directly with the various Program Managers. The potential of such recognition would allow the ARAT to coordinate the technical reprogramming needs of the material developer with current and future reprogramming requirements. The ARAT supports the warfighter by assisting the material developer to satisfy systems requirements through established acquisition policies and procedures. POCs are Mr. Sok Kim/Ms. Pat Thomas/Mr. Mark Russo, DSN: 992-1337

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will be published quarterly and is intended to provide the ARAT community with current information. You are invited to submit input for improving this publication, or present articles which will be of interest to our readers. You may fax correspondence to the Editor at (908) 532-5238. Include your name, telephone number, and source of information.

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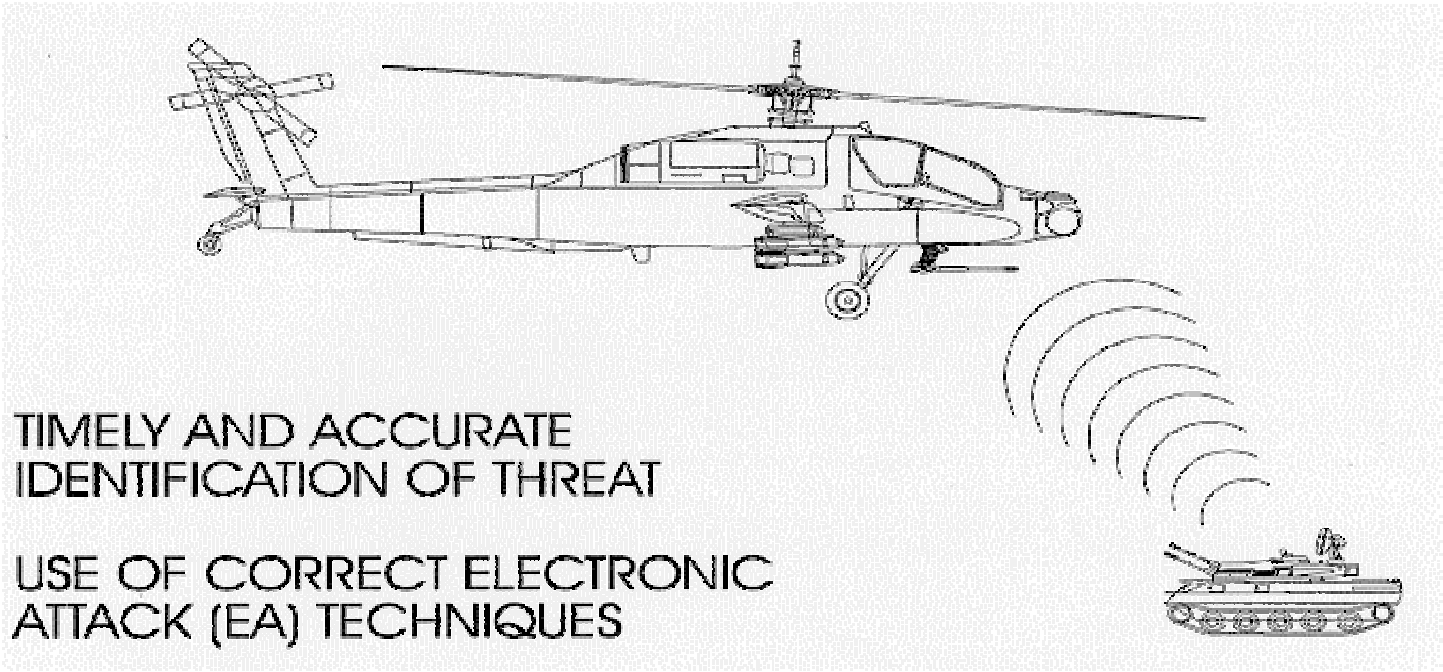
SOME REPROGRAMMING ACRONYMS AND TERMS

"There are those who understand everything till one puts it into words." Mel Brooks 1987

Since the ARAT BULLETIN came on-line, the engineers and techno-writers of the multiplicity of articles have brandished around some ominous looking/sounding acronyms and terms when it comes to the theory and practice of reprogramming Army Target Sensing Systems (ATSS). In a recent conversation with one of the forward deployed Aviation EWO's (Electronic Warfare Officers), we were asked to try and define, in unclassified English', some of those acronyms and terms used when it came to the pulsed Radar Signal Detecting Sets (RSDS). Here is ARAT-TA's interpretation, definition and elaboration of some of the more frequently used items and how they mesh into the overall effort to update aviation electronic combat systems. We have used information from the public domain to illustrate these terms. All references are unclassified!



Radio Frequency (RF): The number of cycles that a radio wave completes in a given period of time, usually one second. However, in today's EW environment, we use the term hertz' (per second). Thus, one hertz equals one cycle per second. In reprogramming an ATSS, ARAT-TA might stipulate to the CECOM programmers that the Jay Bird airborne intercept radar operates in the range 12,000-13,000 megahertz (another way is to say 12-13 gigahertz) [4]. RF is not presently used as a direct reprogramming characteristic for some aviation electronic combat ATSS. However, it is used as a discriminant to determine whether or not the ATSS will see the signal (e.g., if the antennas are built to receive and pass the energy to the Radar Signal Detection Set [RSDS] receivers.) More sophisticated ATSS will use RF to help identify specific emitters.

Pulse Width (PW) (formerly called Pulse Duration): This is the time a radar transmitter is on' or radiating. PW is measured in microseconds. For example, Spoon Rest long range early warning radar has a 4-5 microsecond PW, while Low Blow target tracker (TT) for the SA-3 surface to air missile system has a 0.25-0.5 microsecond PW [1]. One can deduce from this difference that, depending upon the functionality of the radar and its operating RF, PW will play an important role in emitter discrimination.

Pulse Repetition Interval (PRI): The time required for a radar's complete transmission cycle. Put another way, it is the time from the commencement of a pulse of energy to the beginning of the next pulse. Thus, an early warning radar may have a PRI in the thousands' of microseconds, while a terminal threat/ weapon associated radar will usually be significantly lower. The reason is that you want to have more pulses on the target to define its location in angle, range, altitude and speed in order to effectively lock a threat/ weapon on it. Examples of this would be Bar Lock ground control intercept radar with a PRI of 2666 microseconds [3]; and Fire Can, a weapon controlling radar with a PRI of 526 microseconds [3]. Several other PRI types also deserve

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Reprogramming Acronyms & Terms (Continued)

mention. Constant' PRIs are generated by crystal controlled oscillators, and their variation in the interval between the pulses is nominally less than 1%. Such PRIs provide definitive range, and are frequently used in pulse Doppler radars (e.g., the Swedish 9LV 200 MK3 fire control radar [1].) Staggered' PRIs are where constant PRIs are alternated on a pulse-to-pulse basis in a specific sequence. The generation of staggered PRIs permits elimination of blind speeds in Moving Target Indicator (MTI) systems. An example of this is the US AN/TPS-44 early warning radar [4]. Jittered' PRIs are where there are significant variations (consecutively or randomly) in the PRIs. These PRI changes are used as an electronic-countermeasures (ECCM) technique to negate the effects of jamming. An example of this type of radar is Sea Archer, which is installed on Royal Navy Sea King helicopters [1]. There are many additional varieties of PRI, but this should be enough to wet' your appetite. In the reprogramming effort, PRI is an important discriminating characteristic -- both for the older and newer RSDS.

Scan Type: The path or manner in which a radar energy beam operates or traverses in a free state environment. There are two basic categories: simple and complex. Simple scans can be further divided into those where the radar beam can scan in either of two axes: the horizontal or the vertical. An example of a simple scan is the LN-66 naval navigation and surface search radar with a circular or rotating scan [3]. The complex scan is as its name implies, more complex. An example would be the Fan Song TT radar of the SA-2 that uses track-while-scan [2]. There are many more complex scan types, examples of which are: conical, helical, raster, etc., all having different characteristics required for different radar functions.

Scan Rate: Defines the time period it takes to complete one scan or cycle of the antenna. An example of a simple scan rate is the Sea Tiger Mk2 radar with a scan rate of 30 revolutions per minute or 2 seconds [6]. More complex radars may use faster scan rates; for these cases, we normally express the rate in cycles per second. The term used is the illumination rate. An example of a radar with an illumination rate is the Fan Song missile control radar, with a value of 15.5-17.0 hertz [1].

Mission Data Set (MDS): The term used to define a set or group of key emission parameters for emitters of interest. This set of parametric data is loaded (programmed) in a hierarchical or prioritized sequence into survivability equipment (such as a radar signal detecting set, a jammer, a flare dispenser, etc.), and is used by the equipment to detect and identify which system(s) are emitting. Depending upon user requirements, a MDS could include only certain types of emitters (worldwide hostile fire control radars only; all friendly and hostile early warning radars in a given geographic region; etc.) or every emitter up to and including the local gendarmes' radar speed trap!

So we've provided a laundry list of definitions, more or less in English.' So what? Well, having defined some important electronic warfare terms, we can now see a fingerprint' being established for nearly every specific radar that has been developed. Hundreds of parameters are cataloged for each emitter, but no single electronic combat device can detect and classify every emission. Because some types of emissions are more important than others for emitter identification, these are the ones we concentrate on when developing a MDS. Using data bases established and maintained by national agencies and specific analysis tools, ARAT-TA is able to determine the optimum parameters we want to load into the MDS for our various ATSS. From the Flat Face acquisition radar operating from 810-950 megahertz [7] to the Flycatcher fire control radar operating from 8.5-9.6 gigahertz [5], we are able to effectively build, program and deploy MDS that are operationally effective in providing warning to our war fighters and, more importantly, enhancing their survivability. After all, undetected threats can hertz.' POCs are Mr. Harinder Purewel/ Mr. Pete McGrew/Mr. Jim Harrison, DSN: 992-8224.

References and Bibliography:

1. Blake, B., ed., Jane's Radar and Electronic Warfare Systems, Sixth Edition, 1994-1995, Jane's Information Group Inc., Alexandria, VA, March 1994.

2. Cullen, C. and Foss, C., ed., Jane's Landbased Air Defence, Fourth Edition, 1991-1992, Jane's Information Group Inc., Alexandria, VA, November 1990.

3. International Countermeasures Handbook, 1991, 16th Edition, Cardiff Publishing Co., Englewood, CO, 1991.

4. International Defense Electronics Systems Handbook, 1992, First Edition, Cardiff Publishing Co., Englewood, CO, 1992.

5. Meller, T., "Flycatcher - A Versatile All Weather FCS for Low Level Air Defense, Geneva.

6. Rackham, P., ed., Jane's C4I Systems, 1994-95, Sixth Edition, Jane's Information Group Inc., Alexandria, VA, August 1994.

7. Streetly, M., World Electronic Warfare Aircraft, Jane's Publishing Inc., New York, 1983.